RAILWAY ENGINEERING

AND MAINTENANCE OF WAY

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Railway Engineering
and Maintenance of Way

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A CLEAR TRACK

¶ You have heard much about improving conditions in business. We have been talking it for months past. Even if you have not been optimistic before you can see it now. Inquiries for railway supplies have shown a most gratifying increase during the last month. You know what large orders have been placed for new freight cars. All along the line Railway companies are getting busy with inquiries for all kinds of supplies. There can be no doubt now even in the minds of the most skeptical of the return of better business conditions.

¶ Of the million and three-quarters freight cars in service, the number of idle cars has decreased until it is apparent that it will not be long until there will be none. The Steel Corporation's earnings for the last quarter were surprisingly large, $27,000,000 with indications that the present quarter of the year will be the greatest in the last twelve months.

¶ Get ready now to go after next year's orders. A most important part of your selling campaign is your advertising. Get your argument for business before the right men—the men who decide on what supplies and equipment is best for their needs and who are now busy making up their minds what they are going to use.

¶ The feeling of confidence in better conditions is general. The stock and bond market reflects it. It has grown and developed mightily in the last few weeks. We are moving forward at a most promising pace. Get in line with the procession and go after the orders with the strongest and best advertising you know how. There's a clear track ahead.

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Pneumatic Gates.
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Atlantic Equipment Co., New York.
Buda Foundry & Mfg. Co., Chicago.
Indianapolis Switch & Frog Co., Springfield, O.
Hicks Locomotive & Car Works, Chicago.
McCord & Co., Chicago.

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Vol. IV. Chicago, November, 1908 No. 11

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Railway Signal Association

THE twelfth annual convention of the Railway Signal Association was held in Washington, D. C., on October 13, 14 and 15. After President A. H. Rudd called the meeting to order, an address of welcome was delivered by Commissioner McFarlane of the District of Columbia.

During the past year the membership of the association increased to about 1,100, about 200 new members having been elected. The cash balance reported by the treasurer was $2,227. These figures do not indicate fully the progress of this association, for in the last two years the membership has been doubled and recognition has been given to the work of the association by the American Railway Engineering and Maintenance of Way Association, and by the American Railway Association.

Resolutions were carried to the effect that the American Street & Interurban Railway Association be invited to consider the standards of the Signal Association, and that the executive committee be empowered to bring such findings, recommendations, standards and specifications, which are of sufficient importance, to the attention of the American Railway Association, publishing a manual of recommended practice covering standards approved by the American Railway Association.

Amendments to the constitution, affecting the number and date of meetings, membership, election of officers and balloting on amendments to the constitution, were made. It was decided that three meetings will be held each year instead of five, as hitherto. The annual meeting will be held as usual on the second Tuesday in October; one meeting will be held in Chicago on the Monday before the third Tuesday in March and another in New York on the second Tuesday in May. It is probable that the date of the May meeting will be placed three or four weeks later by authority of the executive committee.

The report of committee No. 3 on standard specifications of electric interlocking was adopted with a few amendments. As the report was of considerable length and the specifications had been discussed extensively heretofore, the discussion at this meeting was limited. Supplementary specifications for electric locking for drawbridges were adopted. One amendment, omitting the candle power of convertible signal lanterns, and another amendment specifying that in paragraph 62 reference is had only to detector bars fixed on outside of rail.

The report of committee No. 2 on specifications for mechanical interlocking was adopted. The report was divided into five sections. The first covered the protection of drawbridges; the second, facing point locks; the third, circuits for interlocking signals; the fourth, signal lamps; and the fifth, general specifications. In view of the fact that no code of specifications is satisfactory to everybody and that these specifications are better than those in use, the report was adopted with a few amendments after a limited discussion.

The committee report on storage batteries contained

a historical review of the storage battery and its use in signal work. The report was supplemented by a code of rules for the installation and care of storage batteries which was accepted by the association and will be sent to letter ballot.

Automatic stops and cab signals, covered in the report of committee No. 6, were discussed at length. Elsewhere in this issue the report of the committee is printed. It was decided that insulated wheels and axles were not to be condemned as unreliable and unsatisfactory at the time. The clause in the report designating automatic stops and cab signals as only adjuncts to a fixed signal system was adopted unanimously after much argument. The amended requisites of installation will be put to a letter ballot.

At the opening session on the second day the progress report on signaling practice by committee No. 1 was taken up. After a thorough discussion of the aspects explained by diagram No. 104, which is printed elsewhere in this issue, the report was adopted as a progress report. A sub-committee presented specifications for 1-in. pipe and coupling, for malleable iron castings, for machinery steel, for wrought iron bars, for signal roundels, lenses and glass slides, and for drawings of standard designs for 39 parts in signaling, chiefly mechanical interlocking. With certain modifications of the specifications for pipe the whole report was adopted to be put to letter ballot.

The committee report on rubber covered wire contains tables showing the effects of impurities in copper wire and a description of the properties of copper, besides revised specifications. The changes were adopted by paragraph after extended discussion, and then the report as a whole was adopted. Regarding the exclusion of Kerite from the specifications, due to the specified tests for acetone extract, mineral matter and ash, it was decided that a separate specification for a compound of which the ingredients are unknown should not be made by the association, but should be left to the individual roads. The merits of the compound, Kerite, are, however, recognized by the committee, and it is not the intention of the committee to discourage its use. The paragraph, relating to the percentage of acetone extract, was discussed by several members, some being in favor of reducing the limiting percentage from 6 to 5 per cent, and others favoring an increase from 6 to 10 per cent. It was voted, however, to have the limiting percentage of acetone extract remain at 6 per cent.

On the third and last day of the convention, the report of committee No. 4, covering a set of specifications for automatic semaphore block signals operated by direct current, was considered. The discussion referred particularly to the desirability of making these specifications consistent with those on mechanical and power interlocking. The report of committee No. 5 on specifications for manual block signaling was referred back to the committee. The latter report does not take up single track blocking, but is devoted mainly to the controlled manual systems, consisting of a code of rules for the organization of the signal department, rules for the work of maintenance and keeping of records, and the essentials of installation.

The next annual meeting of the association is to be held at Louisville, Ky. The following officers were elected for the ensuing year: President, L. R. Clausen, superintendent of the Chicago & Milwaukee division of the Chicago, Milwaukee & St. Paul Railway, Chicago, Ill.; second vice-president, C. E. Denney (L. S. & M. S.), Cleveland, Ohio; secretary-treasurer, C. C. Rosenberg, Bethlehem, Pa.; members of executive committee, C. C. Anthony (P. R. R.), Philadelphia; J. C. Young (Union Pacific), Omaha.

Bridge Superintendent's Convention

THE eighteenth annual convention of the Association of Railway Superintendents of Bridges and Buildings, held in Washington, D. C., on October 20, 21 and 22, was presided over by President R. H. Reid. The attendance was good, over 80 members being present. By vote of the convention the name of the organization was changed to the American Railway Bridge and Building Association. This change was due to the fact that the title of superintendent of bridges and buildings is not used extensively by railroads at present. A new constitution was also adopted at the convention. The executive committee was authorized to get up a new desigu of badge for the association.

A report on experiences with gasoline and kerosene engines, or combinations for same for water supply, drawbridges, etc., was taken and fully discussed. The conclusion of the committee is to the effect that gasoline is the best motive power, with the exception of electricity, for intermittent service on drawbridges, turntables, etc., but that it is cheaper to use kerosene in engines designed for gasoline where the volume of water to be pumped is small. The committee did not make any definite recommendations in view of its limited experience.

The discussion of the report on modern dwelling houses for section foremen and section men in outlying districts was to the effect that it pays to provide conveniences for bridge gangs and other employees. Box cars and old passenger coaches are used for housing the men.

Reinforced concrete culverts and the method of constructing reinforced concrete slabs were discussed. The committee on fire protection presented a progress report, the basis of protection being the proper wiring of buildings and the keeping of clean premises.

A report on the construction of cofferdams was presented and discussed. It was said that cofferdams were frequently built too small and that, as it is sometimes necessary to build forms for concrete work inside the dam, a liberal allowance should be made for clearance. The report on preservation of timber covered methods of protecting timber against the elements and the teredo.

The next annual convention will meet at Jacksonville, Fla. The president of the association for the ensuing year is Mr. J. P. Canty, Boston & Maine R. R., and the secretary, Mr. S. F. Patterson, Boston & Maine R. R.

Reinforced Concrete Stone Bins and Trestle

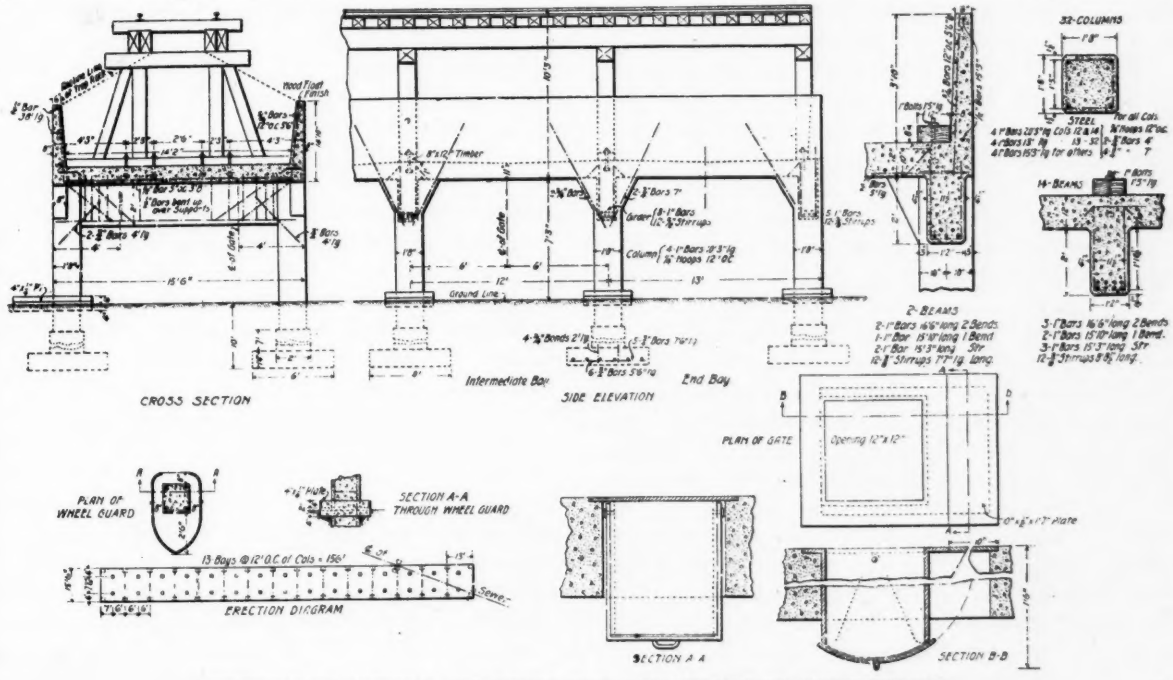
TO facilitate the storing of crushed stone and loading it to teams the street department of Springfield, Mass., Mr. A. A. Adams, superintendent, awarded a contract to the Turner Construction Company, 11 Broadway, New York City, for the design and erection of a combined trestle and stone bins which would enable the broken stone to be dumped directly from the railroad cars into bins and by means of gates in the bottom of the latter transferred to teams which could drive under the trestle. The accompanying photograph gives an excellent idea of the resulting structure.

The Boston & Albany Railroad has a connection with this trestle and runs bottom dump ballast cars out on the wooden trestle which is built on top of the concrete bins. The total length of this concrete structure is 182 ft. The width is uniformly 15 ft. 6 ins. The detailed features of the reinforced concrete work show in the accompanying sections. The wooden trestle which supports the railroad track rests on concrete bents consisting of two columns 20 ins. square connected with a girder 3 ft. deep and 14 ins. wide, with a clear span of 12 ft. 2 ins. Connecting each bent and forming the floor of the stone bins is a 12-in. reinforced concrete slab. Extending above the top of this slab to a height of 4 ft. are two light retaining walls.

The reinforcement used in this work consists of cold twisted bars bent and fabricated according to the regular methods of the Turner Construction Company. The girders connecting the concrete columns are reinforced with six 1-in. bars and twelve ⅜-in. stirrups. The columns have four 1-in. bars banded together at 12-in. intervals with ¼-in. hoops. In addition, in the tops of the columns are four ¾-in. bars running at an angle with the vertical axis of the column of approximately 30 degs. and reinforcing the knee braces which show in the photograph.

The footings vary somewhat in size, but in general are 8x6 ft. and 16 ins. thick, reinforced with a grillage of ¾-in. bars. The depth below the surface approximated 10 ft. The foundation conditions were unusually poor, the soil being soft muck in some places, and at one end of the trestle an old sewer had to be crossed. This was taken care of by a girder footing spanning the sewer. This sewer shows in the accompanying plans. Extreme care was necessary with the soft subsoil conditions to procure a reliable footing for the concrete piers. The work was not delayed, however, to amount to much and the trestle has been in use now about six months without any defects showing.

The method of construction employed was similar to that used on most reinforced concrete jobs. The columns were filled first, then the beams and floor slab cast together, and the retaining wall put on afterwards. This is well shown in one of the accompanying photographs. The work can be followed in this photograph through all its stages. The column reinforcement shows in the foreground, the column and beam forms in place with the men laying steel, and further to the right a recently

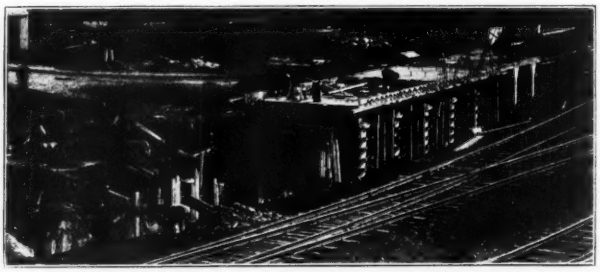


SECTIONS OF TRESTLE AND STONE BINS AND DETAILS OF CONSTRUCTION.

concreted slab. At the extreme right several sections of the retaining wall have been completed and the forms for them are still in place. The method of bonding the columns into the rest of the structure, which goes to take care of the moving loads to which the structure is subjected, is indicated by the reinforcement sticking up into the retaining wall.

For the form work 7/8-in. T. & G. North Carolina roofing was used for all panels. The column forms and girder bottom and sides were made out of 2-in. spruce dressed both sides. The column brackets and all supports under the slabs and girders were of 4x4-in. spruce. For spreaders and incidental bracing 2x6-in. and 2x8-in. spruce was used. The details of these forms show very clearly in the accompanying photograph. Bolting with 3/4-in. bolts was resorted to wherever possible on the wall forms and column brackets.

This entire structure was completed in four weeks



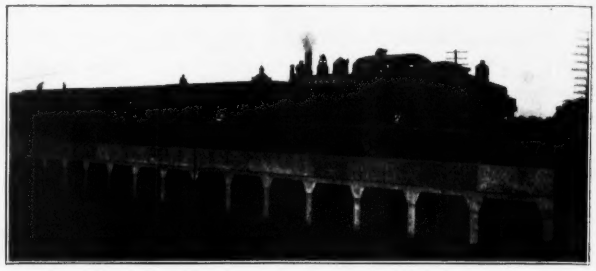
BUILDING THE CONCRETE STONE BINS AND TRESTLE.

after the first excavation was undertaken. The forms were removed two weeks after concreting and the railroad trestle put in place within about a month. The first locomotive was run over the trestle five months after the concrete work was finished. The maximum capacity of the stone bins is about 570 cu. yds. or approximately twenty car loads. The total cost of this work to the city of Springfield was about $8,000.

*The Storage Battery**

THE principle of the storage battery was discovered in 1801 by Gautherot, who experimented with platinum electrodes immersed in a salt solution. Practically nothing was done to develop the principle until 1860, when Gaston Plante, a Frenchman, experimented with a cell consisting of lead strips immersed in dilute sulphuric acid. He discovered that each time the cell was charged and discharged, the amount of current given out on discharge was greater; and further still, that by charging the cell in reverse direction each alternate time, the capacity was rapidly increased. He amplified this process and was able to construct plates having sufficient capacity to make them a commercial possibility. Most of the changes and improvements of the storage battery since this time have been along these lines. Hence Plante is justly considered the inventor of the storage battery.

*From a committee report to the Railway Signal Association.



REINFORCED CONCRETE STONE BINS AND TRESTLE.

Plante's method of charge and discharge in reverse direction caused an increased deposit of active material on the plates due to peroxidizing of the raw lead, thus resulting in an increase in capacity. This method of forming active material from the raw lead was slow and difficult and led to the experiments of Camille A. Faure who in 1881 patented a process of making storage batteries by covering the lead surface with lead oxide paste instead of forming the lead electro-chemically as in the Plante process. One charge only was then required to put the plates in condition to produce their final capacity. In the United States Charles F. Brush developed simultaneously with Faure the same process, so that in this country Brush is considered the inventor and his patents here controlled the process.

All lead storage batteries are today produced by one or both of these processes, so that they are of the Plante type, the Faure type, or a combination of both types, in which case one plate, usually the positive, is Plante, and the other Faure. Storage battery practice of today has therefore evolved through continuous mechanical and chemical improvements from the plates originally made by Plante and Faure.

The commercial use of storage batteries in this country on a large scale began about the year 1893. From this time on storage batteries came into greater use, the most noticeable applications at first being in connection with isolated electric plants, Edison lighting systems, and electric street railways.

In 1896 the Edison Electric Illuminating Co., of Boston, installed a battery of 8,000 amperes. This was the first big step in the use of storage batteries on an extremely large scale. Since then most of the larger Edison plants throughout the country have installed enormous batteries so that at the present date there are 165 such plants operating, aggregating 215,000 kw. hours. The use of large batteries in isolated plants and street railway plants has developed simultaneously so that there are now in operation approximately 1,100, aggregating 316,000 kw. hours.

The most prominent installation of batteries to date is that of the New York Central & Hudson River Railroad, which is now operating or installing 2,692 cells in nine batteries, aggregating 60,000 h. p. hours at the regulating rate in connection with the electrification of the steam road in New York City and vicinity.

The extensive use of storage batteries in connection with signal work on steam roads is practically confined

to the past ten years. In 1898 storage cells were installed on the Pennsylvania west of Pittsburg, these cells charging from gravity cells and discharging upon the signal circuits. It is a matter of interest to note that many of these original cells are still in service.

In 1902 the Pennsylvania installed at Paoli a complete storage battery system and charging plant. The cells were located in the semaphore bases and charged from a circuit running from a centrally located plant over a wire running to each end of the division. The installation probably represents the first large installation of this character.

Both of these systems involve the use of batteries permanently located at operating points—the current for charging being brought to the batteries. This method seems to be almost universal on the eastern roads. In the west, however, not only is this method operated, but also portable storage batteries are used on a large scale, the batteries being removed at fixed intervals, to the central charging point, recharged and returned to the operating points.

In 1900 the Southern Pacific used storage batteries of the portable type in connection with automatics. At this time a Plante type portable battery was used. This battery was of considerable weight but was the standard at that time.

There are now in service about 60,000 cells of portable batteries for signal work, used principally on western railroads.

The use of storage batteries for signal work gained very little importance for several years after their initial use. It was in 1903 that they came into general use and since that time have increased at the rate of approximately 100 per cent per year, up to 1907, when little increase was made.

In 1899 storage batteries of 3,000 watt hours were installed; in 1900, 60,000 watt hours. Following this the years are as follows: 1901, 90,000 watt hours; 1902, 150,000 watt hours; 1903, 625,000 watt hours; 1904, 1,150,000 watt hours; 1905, 2,300,000 watt hours; 1906, 4,700,000 watt hours; 1907, 5,000,000 watt hours.

Weed Destroyer

A METHOD of killing grass and weeds on railroad tracks by spraying the roadbed with a chemical solution has been developed by the Railway Chemical Sprayer Company, Owensboro, Ky. This solution was used on 100 miles of track of the Yazoo & Mississippi Valley Railroad between Baton Rouge and Kenner Junction, La., and this year the company has sprayed 500 miles of track for the Illinois Central Railroad with reported success.

As used on steam roads, the spraying outfit, which is illustrated herewith, consists of a 40-ft. flat car of 100,000 lbs. capacity, carrying two tanks of 4,000 gals. capacity each. At the middle of the car and between the two tanks, there is a cab for the storage of the necessary chemicals and to cover steam heating and

WEED DESTROYER.

other apparatus. In order to effect a chemical mixture of the ingredients it is necessary to heat the water to 212 degrees. On the steam road equipment this is accomplished either by taking steam from the locomotive or installing an individual steam generating plant on the car. In applying the system to electric interurban conditions it is probable the mixture will be prepared at some central point and transported in tank cars.

The car is equipped with air pumps for applying pressure to the solution tanks so that the spraying apparatus will operate at uniform pressure, regardless of the head of water in the tank. The spraying apparatus consists of six nozzles, arranged in a line crosswise underneath of the car and near one end, with pipe connections to both tanks and valves for switching the supply.

The apparatus can do effective work at a speed of about 10 miles per hour. The car has a special indicator and the flow of the solution is regulated according to the speed, so that about 500 gals. of solution are applied to a mile of track for ordinary growth on the track and roadbed.

According to the theory of the promoters, the solution, being breathed in by the plant, becomes mixed with the sap, in this way killing the roots. The part of the vegetation above ground is withered and killed in from 12 to 14 hours, and it is said a plant once treated will not sprout. In some situations, therefore, but one application is necessary during a season, but should there be any weeds or plants the growth of which does not start until late in the season, two applications might be necessary.

The chemical preparation is said to be not dangerous to handle and is not injurious to rails, ties, bond wires, bridges, paint or any portions of the roadbed. The company does not sell the spraying apparatus or the chemical solution, but is prepared to make contracts with railways to thoroughly sprinkle roadbed at so much per mile under guarantee that if the weeds are not killed no charge will be made.

The company has recently made a contract with a representative of the government of Queensland, subject to confirmation by this government, to kill weeds on about 3,000 miles of track each year for five years at the rate of $15 per mile per year.

*Automatic Stops and Cab Signals**

NEW descriptions of devices and specifications were received and the recommendations of this committee have been based upon the knowledge and experience of the members rather than from consideration of descriptions which have been submitted.

Automatic stops were probably thought of and invented shortly after the introduction of the air-brake. A number of patents have been issued for automatic stop and cab signal devices. Many of the devices are so much alike that a decision of a court would be required to determine the particular merit or invention, which each patent is assumed to possess. A majority of the designs show the inventor to be ignorant of the conditions under which a device of the kind must be used. Comparatively few of the devices which have been patented have been tried, and this committe is not aware that any of these have passed the experimental stage and are in regular use on a surface road in the United States.

Automatic stopping devices are in successful use on the Boston Elevated, Chicago Elevated, New York Elevated, New York Subway and the Hudson Tunnel Roads. On these roads, snow and ice do not collect in sufficient quantity to interfere with the working of the apparatus and the road clearances are ample for the construction used. The results have shown the automatic stop to be a valuable safeguard and to have prevented a number of collisions that might have resulted in a loss of life.

The automatic stop and cab signal devices which have been given the most extended trial in the United States are the Miller cab signal, the Kinsman automatic stop, and the Rowell-Potter safety stop. Descriptions of these devices may be found in the technical journals.

In England and on the Continent, cab signals are in use on several roads, there being a need of these on account of the dense fogs, and the unsatisfactory service and large expenditure required for fogmen. No attempt has been made to use a train-control device in connection with the cab signal, as the discipline is such that operating officials do not believe the use of the stop to be advisable or necessary. So successful have the cab signal devices been, that the Board of Trade of England, at the recommendation of Col. Yorke, have allowed roads using an approved form of cab signal to dispense with the distant signal.

The cab signal systems, as used in England, are of the intermittant contact rail type and similar to a number that have been tried in this country. A full description of the Raven cab signal, which is used on the Northeastern Road, is published in the Railroad Gazette of February 14 and 21, 1908. From the trials made on American roads, it is evident that devices of the type used in England cannot be made to work in this country on account of ice and snow forming on the contact rails sufficiently to prevent a contact being made between the part on the engine and the part fastened to the track.

*From a committee report to the Railway Signal Association.

Automatic stops and cab signals may be divided into four general classes based upon the method used in transmitting to the engine or moving train the impulse necessary to operate the automatic stop and give a signal indication in the cab. These with their various subdivisions are as follows: Mechanical trips, overhead, ground; insulated engine parts; contact rails, continuous, intermittent; inductive, alternating current, Hertzian waves.

MECHANICAL TRIPS, OVERHEAD ARRANGEMENT.

Devices of this type are most generally arranged to transmit to the moving train the operating impulse to apply the automatic stop by means of a hanging arm or weight arranged to strike a valve or handle placed on the top of the cab or car and apply the air, in case the signal should be passed when in the stop position.

These systems must of necessity be arranged for the hanging arm or weight to come within the maximum clearance line, and in such position would be apt to strike, with probable fatal results, a man riding on the top of a car. The absence of the arm will result in a failure to stop a train when a signal which is indicating stop is run by. Up to the present time, as understood by the committee, these devices do not conform to several of what they regard as essential requirements for a safe and reliable automatic stop and cab signal system. These requirements have been given at the end of this report and the overhead arrangement of mechanical trip automatic stopping devices do not comply with Nos. 1, 2, 3, 4, 5, 6, 7 and 11.

MECHANICAL TRIPS, GROUND ARRANGEMENT.

Devices of this type are arranged with a movable arm or inclined plane, which when in the operating position is made to come in contact with parts suitably located on the moving train and cause the brakes to be applied, when the train runs by a signal that is indicating stop.

The difficulty met with in operating devices of this type is that the parts on the ground or those on the engine must extend inside of or beyond the permissible clearance lines, in which position they are likely to be broken or knocked out of place, for the parts placed on the ground and for the parts on the train are likely to be hit by objects other than the engaging arm, and the brakes be applied when they should not. Ice and snow seriously interfere with the operation of devices of this kind, and these systems, so far as the committee is aware, do not at present meet requirements Nos. 1, 2, 3, 4 and 7.

INSULATED ENGINE PARTS.

With these systems it is usual to insulate one truck from the other of the engine or car, insulate an engine from its tender or, insulate one wheel from the other by means of a split axle or insulated wheel center. Pressed fibre is the material by which this insulation is most generally accomplished. With any of the above mentioned arrangements it is necessary that the indication be conveyed to the moving train during the interval of time in which the insulated part is passing over a short insulated section of rail or an insulated joint in the track. The operating impulse is, therefore, momentary and is not continuous.

The principal difficulty met with in systems of this kind is to properly construct and maintain the insulation of the engine parts and to insure that the parts on the moving train will operate properly in the short interval of time available. These sytsems, it has been found, do not conform to essential requirements Nos. 1, 2, 3 and 11, as recommended by the committee.

CONTACT RAILS, CONTINUOUS TYPE.

Devices of this type are arranged to conduct the operating signal impulse to the moving train by means of a shoe attached to the train making contact with a third rail placed alongside of the main rail, between the main rails, or above, or on the side of the train.

The difficulty experienced with devices of this type is to secure a continuous contact on the third rail, for, unless this is done, the device operates and the brakes are applied when there is an opening in the third rail, irrespective of whether or not the operating conditions make it necessary or desirable that the train brakes be applied.

The continuous type of contact rail system, as at present understood by the committee, do not conform to requirements Nos. 1, 2, 3, 4 and 11.

CONTACT RAILS, INTERMITTANT TYPE.

With these systems the contact is usually of moderate length and is placed at a point where it is desired to convey the operating signal impulse to the moving train. These points are at the commencement of a block, or where a home or dwarf signal is placed. The indication given on the train is continued from the time a train passes one contact to the passing of the next contact, or to one where the indication is changed.

The principal difficulty to be overcome in the development and use of devices of this type is to insure that the indication will be received on the moving train, and when received will not be improperly changed before the next contact point is reached.

These systems, as developed, do not fully meet requirements Nos. 1, 2, 3, 4, 7 and 11.

INDUCTIVE, ALTERNATING CURRENT TYPE.

The committee is not aware that apparatus of this type has been tried. As described, the system is quite similar to the intermittant contact rail scheme, except that the operating impulse is conveyed to the moving train by induction, a coil of wire attached to the track acting on a suitably arranged coil placed on the train. The arrangement can be made to keep within the clearance lines and seems to be capable of successful development provided the necessary alternating current is available at the many points where same will be required.

Requirements Nos. 1 and 2 do not appear to be complied with by systems of this type, of which the committee has knowledge.

INDUCTIVE, HERTZIAN WAVE TYPE.

This type of apparatus makes us of a generating device placed on a train or at a fixed point from which the Hertzian waves are sent out, preferably in the direction in which it is desired to give the indication. A collector of suitable form and arrangement is placed on the train or point at which an indication is to be received and the proper Hertzian waves are supposed to be collected and actuate the apparatus to give an indication.

The principal difficulty with apparatus of this type is in selecting the particular train or fixed point which is to receive the intended indication and to provide protection for a train when there is a failure of the wave generating apparatus.

It is understood by the committee that these systems do not comply with the following requirements for safe and reliable working: Nos. 1, 2, 3 and 6.

RECOMMENDATIONS.

Up to the present time descriptions and drawing of automatic stop and cab signal devices referred to this committee have not included those which seem to be the best and most practicable. Your committee is not in a position to, and does not think it advisable, to recommend for trial any type of cab signal or automatic stop device with which they are familiar, believing that demonstrations of the practical workings of these systems should be made by the patentee, the manufacturer, or under the auspices of the block signal and train control board of the Interstate Commerce Commission.

That those interested in the design and manufacture of automatic stop and cab signal devices for use on surface railroads may know of the operating conditions under which these systems will be used, and the requirements as to safe and reliable working which must be met in order that these devices may have the approval of this association, your committee submits for adoption the following requisites of installation to which automatic stop and cab signal systems must conform, to be considered safe and reliable in operation:

REQUISITES OF INSTALLATION.

1. Apparatus and circuits so constructed that a failure of any essential part will cause the display of a stop signal indication and also the working of the automatic stopping device. The apparatus shall, if possible, be so arranged that the stop shall not be operative or effective at speeds less than 5 miles per hour.

Note: To comply with this requirement, it is practically necessary that circuits be arranged with power supply at one end and controlled relay or operating device at the other end of each circuit.

2. The train control feature must be applicable for use with the absolute or the permissive block system.

With either system the release of the stopping device must be within the control of the engineman or trainman, but only after the speed of the train has been reduced to five miles per hour or less.

3. The auomatic stopping device must be operative only in the direction of traffic, except in connection with signals governing reverse movements.

4. The system must be operative under all weather conditions and at any speed in excess of five miles per hour.

5. The system must be adaptable for use with a block system using track circuits.

6. The system where track circuits are used must give protection against a broken rail, the ends of which have separated, or where a rail or section of a rail has been removed from the track.

7. The parts on the moving train must not extend beyond the maximum clearance lines and the parts on the ground must not extend within the maximum clearance lines, except for a space of two (2) feet above the top of the rail, within which distance the parts must clear the maximum equipment line.

8. An overlap equal to the breaking distance for the maximum permissible speed must be provided for an automatic stopping device.

9. Emergency application of the brakes should be made only when a home or dwarf signal has been run by, when indicating stop. If the system is arranged to cause an application of the brakes when a train passes a distant signal that is indicting caution, the application of the brakes must not occur if the home signal is indicating proceed, or if the speed of the train is under such control that the train will be stopped before passing the home signal.

10. The circuits must be arranged to allow two or more engines to be used with one train, or to allow one train to push another train without having the automatic stop applied at each home signal, or to require the speed to be reduced to five miles per hour when passing a home signal that is indicating proceed.

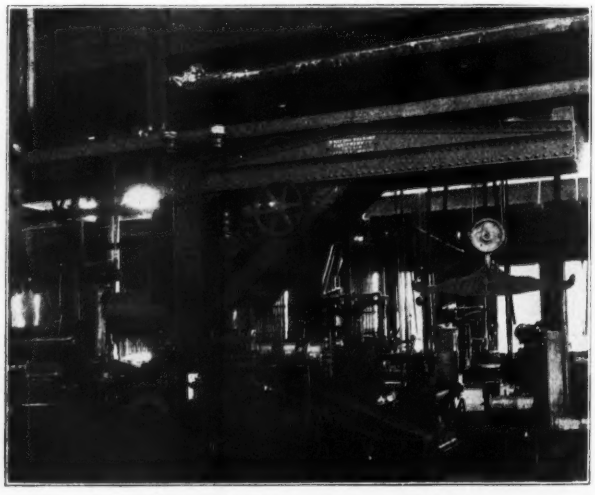
11. The automatic stop must be adaptable for use with electric traction systems, using direct or alternating current for train operation.

12. The automatic stop and cab signal should be considered only as adjuncts to a fixed signal system.

Note: This is on account of the impossibility of properly checking the work of the engineman if a cab signal or automatic stop is used without a fixed signal and also from the necessity of informing the engineman of the exact commencement of the block and the point at which the indication received in the cab shall become effective.

COMMITTEE.

W. H. Elliott (chairman), A. R. Raymer (vice-chairman), E. M. Weaver, G. D. Fowle, J. V. Young, G. N. MacDougald, W. E. Bullard, G. H. Dryden, E. C. Graham, J. A. Beoddy, W. McCrafton, H. J. Foale, D. M. Case, E. E. Mack, Wm. Hiles, A. C. Holden, J. R. Decker, G. W. Hulshizer.



ELECTRIC WALKING JIB CRANE.

Electric Walking Jib Crane

AN electric walking jib crane, installed in the Burnside shops of the Illinois Central Railroad Co., is shown in the accompanying half-tone. The function of this jib crane is to pick up the wheels and axles, distribute them through the shop to wheel lathes or elsewhere if desired and also to place wheels in storage. It is manufactured, designed and installed by the Whiting Foundry Equipment Co., Harvey, Ill.

The crane is of seven tons capacity, four motor, 12 ft. effective radius. It is supported on one track rail, top of mast being supported by I-beam track; requiring minimum floor space. All wearing parts are easily accessible for oiling and repairs. It was specially designed for this railroad and for the work it will perform. A feature to be noted is that of the low head-room.

The four motors are distributed as follows in the working of this crane: One for traveling crane, one for trolley, one for rotating jib, one for hoisting.

An important feature not to be neglected is the fact that load is always in absolute control, being automatically sustained at all times. The hoisting gearing is provided with improved double automatic safety brake, so arranged that the load may be raised and lowered by power and be automatically sustained. This brake attachment consists of two independent brakes, one electrical and one mechanical. The electrical brake is operated by an electric solenoid in circuit with the hoisting motor, and so arranged as to come automatically into action when the electrical current is off the hoisting motor circuit.

A maximum of efficiency is claimed for the service the crane is designed to perform, together with a minimum of cost as to installation and repairs. It is instanced as one of the many crane installations of this company facilitating production in modern plants.

The crane travels on a permanent mono-rail track, running the entire length of the shop at right angles to the erecting pits. The track is laid as close to the columns separating the erecting floor from the machine shop floor as clearance permits, so that the crane serves the erecting pits on one side of the track and the wheel lathes on the other.

The hoist motor is 15-h. p. and hoists 16 ft. per minute. The trolley rack motor is 2-h. p. and racks trolley on jib at rate of 90 ft. per minute. The jib rotating motor is 2-h. p. and swings jib at rate of two revolutions per minute. The crane travel motor is 10-h. p. and travels crane 160 ft. per minute.

The jib is fixed in horizontal position—not raised or lowered. The maximum lift of hook from rail is 10 ft.

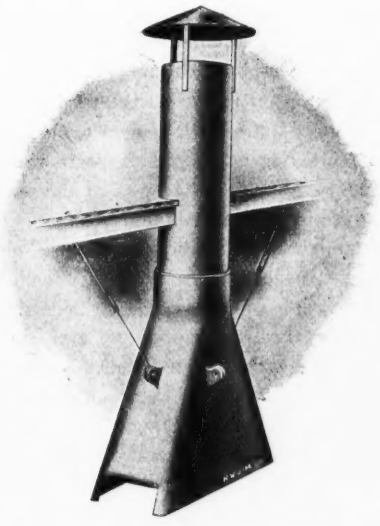
New Fireproof Smoke Jack

A NEW fire-proof jack has recently been brought out by the H. W. Johns-Manville Co., of New York. It differs from the ordinary "built up" jack because it is not made of many pieces held together with flanges and bolts, but consists of only three separate and distinct parts, each of which is in one piece without a seam or joint of any kind.

The Phoenix jack is made of a fireproof plastic material which is moulded into the desired shape and sets hard in a few hours. When thoroughly dry, it is almost as hard as iron and is extremely strong and durable. The materials used in its construction are absolutely fire and acid proof and the jack is not affected in any way by heat, moisture, acids or the gases of combustion. The entire jack is reinforced with extra heavy galvanized iron wire cloth, which is imbedded in the material and gives it exceptional strength and rigidity. The entire structure of the jack, when first assembled, consists of three parts, the hood, the circular stack and the cowl, all of which are finally fastened together with Phoenix compound in plastic state, producing a one-piece jack.

The jack is supported entirely by hanging rods attached to eye openings in the hood. These openings are made of the same material as the jack and are reinforced with heavy wire cable, the ends of which are unraveled and interwoven with the wire cloth. This makes the eyes strong enough to sustain the weight of the entire jack and by spreading the rods attached thereto the weight becomes distributed over a large area of the roof.

After the jack is in place these rods are covered with Phoenix compound to prevent deterioration. The interior of the jack is perfectly smooth, without any protruding bolt heads or flanges and it offers therefore an unobstructed and smooth surface with no tendency to prevent the escape of the smoke.



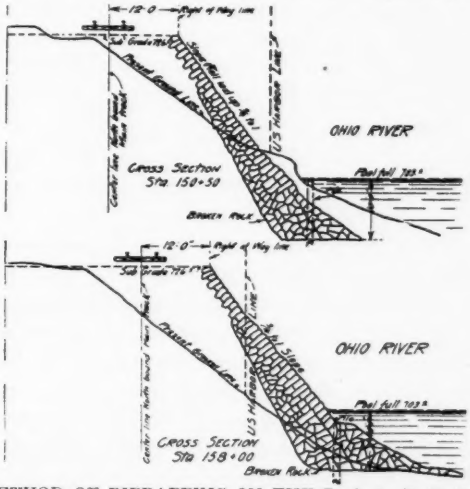
NEW FIREPROOF SMOKE JACK.

The jack is made in standard sizes or any special size that may be required. It is constructed from materials and moulds which are shipped to the round house, where the jack is made and set up. The average thickness of the jack is 5/8-inch, and the weight from 4 to 4½ pounds to the square foot.

*Protection of Embankments by Riprap**

RIPRAP on the Pittsburg & Lake Erie R. R. is a very important matter, as this road runs close to the banks of the Mahoning, Ohio, Youghiogheny and Monongahela rivers at several points between Youngstown on the Mahoning river, New Haven on the Youghiogheny river, and Brownsville on the Monongahela river, for a distance of 165 miles along these rivers.

At some points where ripprapping is required and the tracks are far enough away from the harbor limit to permit, the riprap is done by throwing the stone over the bank, letting them roll or slide down, making a slope about 1½ to 1, the slope varying in thickness from 2 to 4 ft. We use for this quarry spalls or small stone such as can be handled by one man, and in some cases we use furnace slag, which becomes hard from the effects of the weather and makes very good ripprapping, which costs from one to two dollars per square yard.



METHOD OF RIPRAPPING ON THE P. & L. E. R. R.

At points where we are close to the harbor line we use stone such as can be handled by one man and laid in place by track laborers on a slope of 1 to 1, varying in thickness from 2 to 3 ft., costing about $3 per sq. yd. Please see illustration of ripprapping where stones are laid in place along the banks of the Ohio and Monongahela rivers at Pittsburg.

In ripprapping piers and abutments of bridges we use in some cases, where the current is not very rapid, small stone such as can be handled by one man, and where the current is very rapid we use large breakwater stones, usually dropping them around the piers or abutments, allowing them to find their own bearing.

*Report of a Committee to the Association of Railway Superintendents of Bridges and Buildings.

In all cases I would prefer the large breakwater stones filled in with small stones to fill up the crevices between the large stones and make the riprapping as compact as possible to prevent any washing.

F. Ingalls, superintendent buildings and bridges, Northern Pacific Ry. Co., Jamestown, N. D.—On most waterways of the Northern Pacific Ry., through the prairie country of North Dakota, we use boulders which can be picked up on the prairie and loaded on cars for $1 per cu. yd. and placed for 75 cts. per yd. We also use stone for protection of banks from wave wash, where permanent protection is required. For temporary protection in times of occasional high water we use sand bags and fascines.

Portable snow fence is also used in emergencies. This fence is made in panels 16 ft. long and when placed along the bank will break the force of the waves.

At one place where we have a mile of track exposed to occasional wave wash we have sodded the banks, but have had no high water there since the banks were sodded, so we cannot say what the benefit will be, but believe it will give good protection. At the crossing over the Missouri river we have experienced all kinds above the bridge. The bridge itself is protected by dykes of trouble from bank cutting for approximately two miles built of piles, fascines and rocks. For the protection of banks above the bridge, dykes were built of mattresses composed of willows and stone and held in place by piling. Most of this work was done by the government, as the cutting of the banks endangered Mandan on the west side of the river and would also have destroyed the harbor for boats at Bismarck on the east side of the river.

J. S. Berry, superintendent of buildings and bridges, St. Louis Southwestern Ry. Co., Tyler, Tex.—One of my first methods is to first slope the embankment to a pitch of 3 to 1 and drive piling at the toe of the slope abopt 50 ft. apart; then weave a mattress of willow of sufficient length so that it will lay from the toe of the slope out into the river about 50 ft. The mattress is then sunk with rock and placed in proper position and the entire bank is then riprapped with rock all the way and about 10 ft. at the top of the bank, so that high water cannot cut in behind it. I consider this method of bank protection practical and it has proven satisfactory. It will cost approximately $8 per running foot of embankment.

I have been using another method which has proven very effective, this being to drive deflecting dykes, piles being driven about every 8 ft. apart, dykes spaced about every 30 ft.; 2x6 planks are spiked onto the piles about 6 ins. apart from the top of the piling to the bottom of the stream. These deflecting dykes will collect the debris and the chambers will gradually fill in and form a bar. I also consider this method effective in case of very rapid currents and it will cost approximately $6 per lineal foot all complete.

There are other methods used, some of them being quite effective. There is what is known as the system of mud rafts and hollow fascines. These are generally constructed out of willows and poles, then put into proper position and anchored. They will gradually fill in with sand and silt from high water and sink in place, and the embankment usually fills in behind it. It also has a tendency to check the current. However, this is expensive work, costing $9 per lineal foot. The mud rafts cost about $6.

Signaling Practice

IN accordance with the instructions of the executive committee, the work for the year of 1908 has been divided into two sections.

1. Further development of a method of uniform signaling, which has been considered by the committee as a whole.

2. Development of standard designs for signal apparatus, which has been considered by a sub-committee, with the following personnel: J. C. Mock, chairman; F. P. Patenall, C. C. Anthony, J. A. Peabody, Thos. S. Stevens.

Your attention is invited to the action taken on the report of the Committee on Signaling Practice, submitted to the association at the annual meeting of 1907, and appearing on pages 321 and 327 inclusive, of Vol. X of the proceedings. This report was adopted by the letter ballot of this association, returns from which were announced in February, 1908. The same report was submitted to the American Railway Engineering and Maintenance of Way Association by its signal committee No. 10 and was adopted practically without dissent at the annual meeting of March, 1908. The report has also been submitted to the American Railway Association, but up to August 1, 1908, no action has been taken by that body. While not specifically so instructed, your committee has assumed, in carrying on its work for this year, that: 1. The 1907 report contains a list of signal indications, which is reasonably complete, and contains the essential and practicable indications. 2. That the work of the committee for the year 1908 should be the development of aspects for the several indications.

In view of the action taken at its meeting during the period from 1904 to 1908, and, after a prolonged discussion of signal practice and signal aspects in Pittsburg, December, 1907, your committee was of the opinion that the best progress in the development of aspects would be made if this subject was handled by a sub-committee of three members. In accordance with this feeling, a sub-committee, consisting of M. H. Hovey, chairman; Azel Ames and Frank Rhea, was appointed and instructed to obtain from each member of the general committee his scheme of aspects to represent the indications appearing in the 1907 report, exhibit No. 1, page 323 of Vol. X of the proceedings, review the several schemes and submit

*Progress report of Standing Committee No. 1 adopted by the Railway Signal Association.

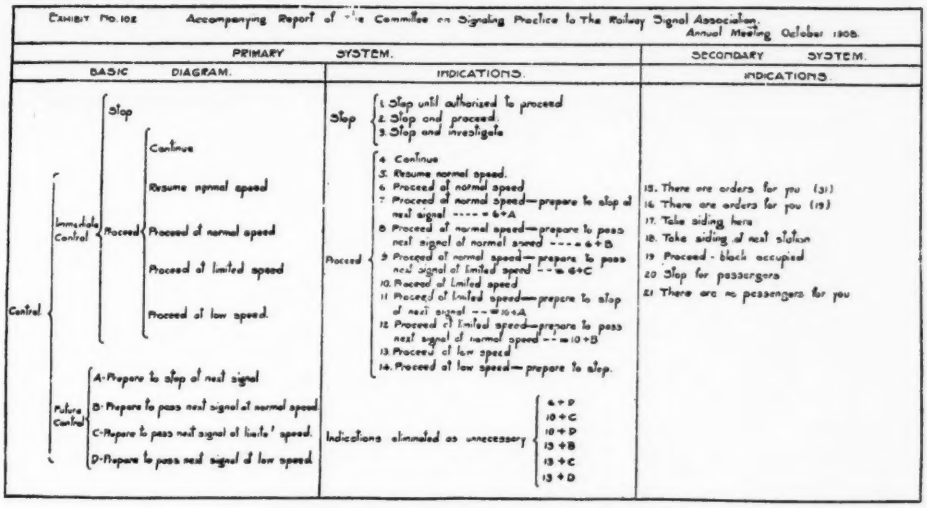


EXHIBIT NO. 102, SIGNALING PRACTICE.

a report based thereon at the next meeting of the general committee. This report was submitted at the Buffalo meeting, May, 1908.

In the work of the sub-committee on aspects and the discussion of the same at the Buffalo meeting, it was found desirable to change the arrangement and wording of the indications appearing in exhibit No. 1 of the 1907 report above referred to. The sub-committee was, therefore, instructed to revise this exhibit, as found necessary, and submit revised diagram, with accompanying aspects, to the general committee at its Detroit meeting, July, 1908, which has been done.

In addition to the revision of exhibit 1 by the sub-committee, revisions of this exhibit were also submitted by two other members of the committee. After a very full discussion, exhibit 102, included in this report, was approved and adopted by the committee. In explanation of this action, your committee invites your attention to the following:

On page 322, Vol. X of the proceedings, this conclusion, taken from the 1907 report, appears: "It is, therefore, the conclusion of committee that, in a system of signaling, the aspects should primarily serve to indicate what is required of the engineman in the control of his train, and secondarily should provide for the giving of certain additional useful information, limited by the reasonable practicability of displaying the necessary aspects and the added burden upon the engineman's memory that will result from the use of many aspects." In addition to the above conclusion, it should be held in mind that the basis of the proposed uniform system of signaling included in the 1907 report, is the control of the train by the engineman.

Upon a close analysis, it was found that exhibit No. 1 had not been developed strictly in accordance with the basis and conclusions immediately preceding, but on the other hand, that they had been departed from materially. This is especially the case with the wording of the indications. Stating this criticism in another way: The basis of the proposed system had been disregarded to a certain extent, in grouping and wording the indications.

Exhibit No. 102 will be found to agree with the basis and conclusions of the 1907 report. The immediate work of this committee is then, to provide logical, practicable and consistent aspects for the indications of this exhibit. Your committee has been able to reach a decision as to

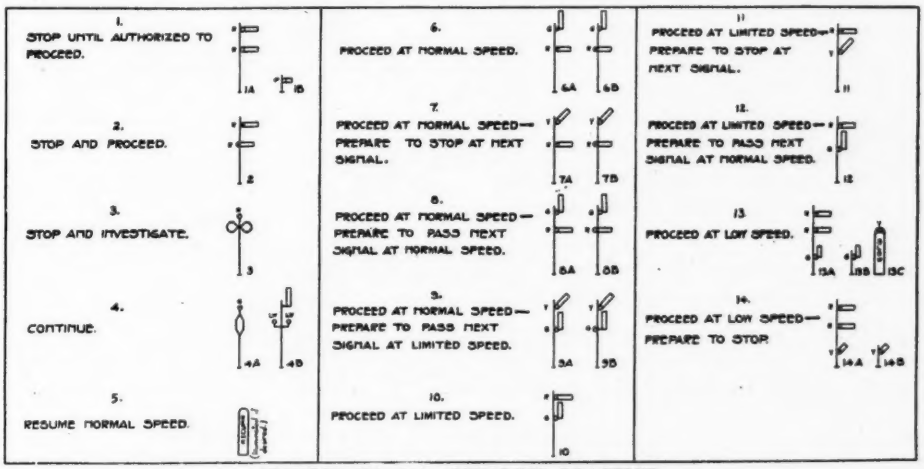


EXHIBIT NO. 104, SIGNALING PRACTICE.

the aspects for the primary indications, and submits them herewith, in exhibit No. 104, for your information.

Your committee has not been able to decide upon the aspects for the secondary indications, but has this matter now under consideration with the expectation of final results for report to the association at the 1909 annual meeting.

At the Detroit meeting four different series of aspects for these indications were presented by as many members, but your committee was not ready to accept any one of the four. It is the committee's plan to compare the four series, and any further that may be presented, very carefully and invite full discussion by all members before conclusions are attempted. A sub-committee, composed of Messrs. Stevens, Rhea and Mock, has been appointed to develop and present a consistent series of aspects for the secondary indications at the next meeting of the committee.

COMMITTEE.

A. H. Rudd, chairman; L. R. Clausen, vice-chairman; Azel Ames, Jr., C. C. Anthony, H. S. Balliet, J. C. Mock, F. P. Patenall, J. A. Peabody, T. S. Stevens, Frank Rhea, M. H. Hovey, H. H. Temple, H. S. Cable and C. A. Christofferson.

*Waterproofing of Concrete Covered Steel Bridge Floors**

OUR information indicates that in all waterproofing either some asphalt or tar is used, the tendency being more and more in the line of pure asphaltic compounds. In the majority of cases at the present time either a felt or a fabric such as burlap is used, which is thoroughly saturated and bonded together with an asphaltic preparation, being generally applied when hot by the use of brushes or mops. In other cases the asphalt is used in a mastic form without any felt covering or fabric being introduced.

This matter is still in an experimental stage with most of the railways. Considerable work is being done along this line, but sufficient time has hardly elapsed to fully determine the value of the different kinds of waterproofing with regard to durability and effectiveness. There is attached to this report a new set of specifications and instructions for waterproofing metal and masonry structures as prepared by Mr. W. H. Finley, Assistant Chief Engineer, Chicago & North-Western Railway Company. This specification supersedes an earlier specification of Mr. Finley's embodied in a paper read by him before the Cement Users' Association, which specification has been generally adopted.

This committee is not prepared to recommend any particular kind of waterproofing. The various methods in use by various roads as shown in reports attached hereto would indicate that all of these have some merit and each particular condition calls for some slightly different treatment and no one method can be said to be the best for all cases.

*From the report of a committee to the Association of Railway Superintendents of Bridges and Building, Washington, D. C., Oct. 20, 1908.

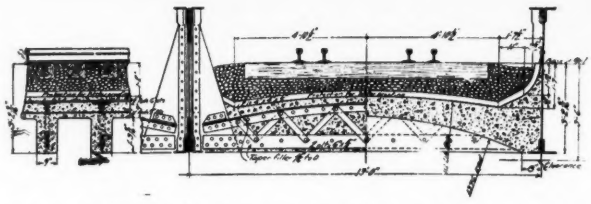


FIG. 1—WATERPROOFING BRIDGE FLOORS, N. Y., N. H. & H. R. R.

CIRCULAR OF INQUIRY.

The committee on subject number one for a report to the next annual meeting to be held at Washington, D. C., October next, would like to get information on the different classes and methods used in waterproofing steel concrete covered solid floor bridges, and hope we will have your hearty co-operation and an early reply to the following questions with prints or sketches if you can conveniently do so:

A. In your solid floor construction do you use I-beam or trough system of floor?

B. Do you use a girder span? If so, how do you prevent water following line of girder and gussets where the adhesion of concrete and iron is imperfect?

C. If trough floor system is used and supported by horizontal beam and columns, do you have any trouble on account of the expansion and contraction of metal cracking the concrete or waterproofing in this kind of construction?

D. Do you use a mastic or an asphalt cover over concrete; if so, how is it applied and what results do you get?

E. Do you use a felt covering over concrete; if so, how many layers, and how is it applied?

F. Do you protect your waterproofing from stone ballast or gravel; if so, what method is used to prevent a puncture?

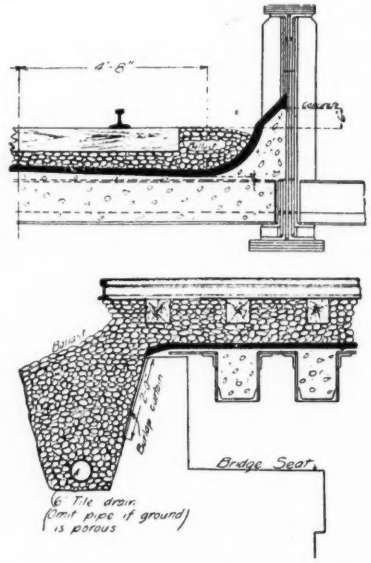
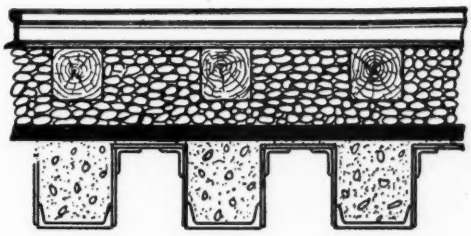


FIG. 2—N. Y., N. H. & H. METHOD OF WATERPROOFING BRIDGE FLOORS.

G. If you have any other method than those outlined above which are impervious to water, we will be thankful for any other information you may have on this subject.

W. H. Moore, New York, New Haven & Hartford Ry—I am sending you blue prints showing the methods which have been employed within the last year for waterproofing solid floor bridges on the Harlem River branch, but I may say that this work has not been in service long enough for us to form much of an opinion as to the efficiency of the systems used. The drawings contain the general specifications for doing the work.

I think it is come to be very generally recognized that in order to be effective, the waterproofing material must have a good smooth surface to rest on without any sharp corners or angles, and that the waterproofing layer must in turn be covered by a protective coating which will prevent it from injury when track is being tampered or otherwise, and also protect it from the direct action of the sun.



WATERPROOFING.

After surface of concrete has been cleaned, apply a coat of Sarco Concrete Paint. Over this mop a thin coat of hot Sarco No. 6 Waterproofing. On this second coat lay a mastic coat 1¼ inch thick, in proportion of one part Sarco Waterproofing to four parts of sand, or sand and pebbles, finished to a smooth finish. Over this put a finishing coat of hot Sarco Waterproofing, spread thinly and evenly, and sprinkle with torpedo sand.

Protect expansion joints by a fold of burlap saturated with Sarco No. 6 Waterproofing.

Carry the water back of the abutments by a curtain of burlap saturated with Sarco No. 6 Waterproofing.

FIG. 3—N. Y., N. H. & H. METHOD OF WATERPROOFING BRIDGE FLOORS.

In our solid floor construction, we have hitherto principally used the trough system of floor, but in certain instances have used I-beams. We are now using on some of our through and deck plate girder bridges reinforced concrete floors.

In the girder spans the waterproofing is carried up the side of the girder a short distance above track level and in some cases a water guard is used, as in the well-known Hydrex system, while in some cases the water guard is omitted and the adhesion of the waterproofing to the web of the girder depended on to maintain a tight joint.

In trough floor bridges of three or more spans where the expansion has to be taken care of in the troughing, we have put in special construction with copper flashing to make allowance for the expansion. This construction, however, has not been in service long enough for us to know whether it will be entirely satisfactory or not.

The waterproofing is protected from the stone ballast either by a layer of brick work or by a layer of mastic, 1¾ to 2 inches thick.

F. E. King, Chicago, Milwaukee & St. Paul Ry.—A. In none of the work done under my direction have trough floors been used. Our solid floors are usually

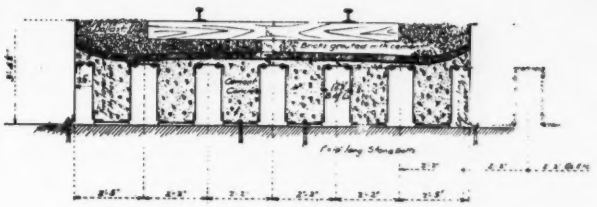


FIG. 4—TROUGH FLOOR SYSTEM ON THE P. R. R.

constructed by using I-beams encased in concrete for spans of considerable length. For spans up to about 20 feet we generally use a reinforced concrete slab.

B. A great many of our girder span bridges are decked with concrete. Where deck spans are used and the conditions will not permit the deck being built in place slabs of about three feet in length for the full width of roadway are constructed of reinforced concrete and set in place by means of a derrick car. In setting these, cement mortar is spread on the girders to protect the top of the girder from rust and also to insure equal bearings. The joints between successive slabs are grouted to prevent water from leaking through, proper drains being furnished at the side to take care of the water. In none of the work under my direction have we used any waterproofing on this style of structure. In the case of a concrete deck on a through girder bridge, the structure put in under my direction, the deck was built in place. In this structure we did not bring the concrete in contact with the main girder or gusset plates. We left an opening of five inches at the bottom of the slab and four inches at the top, between the concrete and the girder and gusset plates. We have therefore experienced none of the trouble to which you refer.

C. I have never put in any trough floors on concrete decks. The question of cracking the waterproofing and the concrete around the gusset plates on through girders has, I understand, come up in connection with bridges not on my territory. I believe we have had some trouble on this score, although I have had no personal experience in the matter.

D. I have used both an asphalt cover on concrete and an asphalt and mastic cover on concrete. The covering used is an asphalt preparation manufactured by

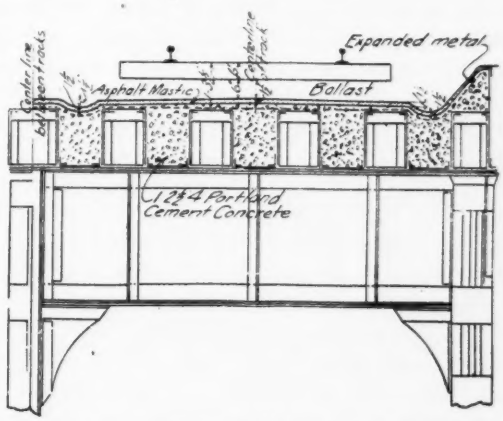


FIG. 5—TYPICAL CROSS-SECTION OVER ROADWAY ON THE C. & N. W. RY.

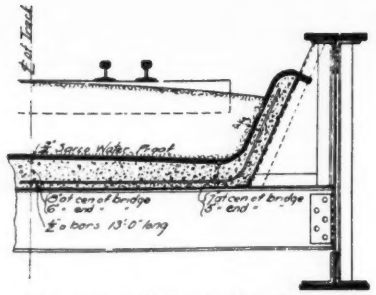


FIG. 6—L. S. & M. S. METHOD OF WATERPROOFING BRIDGE FLOORS.

the Standard Asphalt & Rubber Company, of Chicago, and sold under the name of Sarco. The method of application is as follows: The concrete was first thoroughly cleaned of all dirt and scales and also thoroughly dried. The concrete was then coated with a priming coat of Sarco; this was applied cold with brushes. Over this priming coat one, and in some cases two, coats of hot Sarco No. 6 were mopped. The priming coat furnishes the bond between the concrete and the waterproofing. In cases where this waterproofing was applied to a viaduct (and hence a pavement was laid over the roadway) no protection was provided for this waterproofing other than the sand cushion under the brick. In cases, however, where the concrete was to carry the railroad track, one inch of sand mastic was spread over the waterproofing coat and smoothed down with hot irons. The mastic used was composed of about one part of Sarco to four of sand. In preparing this, the Sarco was heated in closed kettles to the required temperature and the sand added. I am unable at this writing to give you any information as to the results, as in no case has this class of material been used by us for any length of time.

E. On but one job have I ever used felt in connection with waterproofing. That case was a 64-foot reinforced concrete arch. The arch ring was waterproofed with four coats of Barrett's pitch and three layers of felt. The method of application was as follows: The concrete was thoroughly cleaned and dried. Over the concrete a thin coat of hot coal tar was spread. This was followed with a coat of hot pitch; on the hot pitch was spread a layer of felt and mopped down; then a coat of hot pitch and then another layer of felt, and the operation repeated until four layers of pitch and three of felt were applied. Up to the present time this waterproofing has been very satisfactory.

F. We have protected our waterproofing with a coat of sand mastic. This, however, was in places where our ballast came in direct contact with the waterproofing. In case of a culvert deck or arch ring, I see no reason for using a mastic, provided there is a layer of dirt between the concrete and the ballast. In that case, however, the first layer of dirt placed on the concrete should be put on with sufficient care to prevent any stones in the material cutting the waterproofing.

G. I have used no other successful method of waterproofing than those outlined above.

C. W. Richey, Pennsylvania R. R.—A. We use both I-beam and trough section in our solid floor construction, with a preference, however, for the trough floor. Our present standard calls for trough section parallel to the rail for spans up to and including 30 feet. With this arrangement we have a fascia girder on each side of the bridge to hold the ballast.

B. Where solid floor is desired for spans longer than 30 feet we use girders and run the trough section normally to the girders, connection being made directly to the web of the girders. With this arrangement our waterproofing is run above the ballast line, the steel work remaining unpainted until waterproofing is applied, in order to provide proper adhesion.

C. We experience considerable difficulty with all forms of waterproofing used under conditions noted in your question, excepting a waterproofing built up of felt paper.

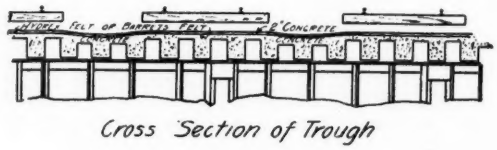
D. We have used asphalt, pitch and other preparations, usually 1 to 1½ inches in thickness, on the top of a properly troweled cement bed. This method of waterproofing to my mind is unsatisfactory, as it cracks in time, permitting leaks.

E. Our standard at present consists of five alternate layers of Hydrex felt and Hydrex compound, all being placed on the top of the concrete, which has been smoothly troweled to provide proper drainage of water.

F. We protect our waterproofing by means of hard brick laid flat. After being laid it is thoroughly run with grout.

G. I know of no other method more satisfactory than the felt covering laid in either asphalt or pitch composition. Expansion or contraction of either the steel or concrete work has no effect on this style of waterproofing.

At our Union station, Pittsburg, the driveways and Adams Express department are under a trough floor system which was originally waterproofed with a 2-inch thickness of asphalt. This leaked very badly and to overcome this we applied an additional inch of asphalt,



Cross Section of Trough

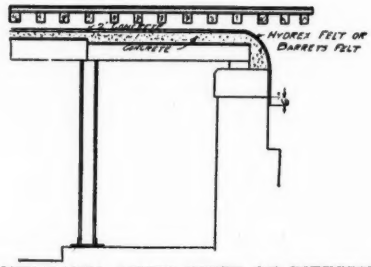


FIG. 7—PENNSYLVANIA LINES WEST OF PITTSBURG, SECTION OF TROUGH.

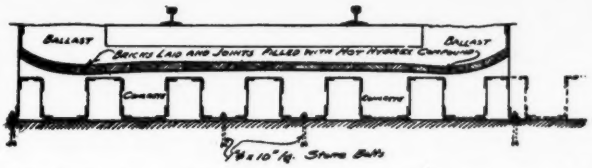


FIG. 8—P. R. R. METHOD OF WATERPROOFING BRIDGE FLOORS.

then covered with felt paper, following the Barrett specification for a paper roof. This piece of waterproofing averages 60 feet in width and is about 275 feet long. Since repairs as above noted were made we have never had a leak.

I am attaching herewith a drawing showing a typical section through a trough floor system, in which you will note our method of waterproofing and its application.

I. F. Stern, Chicago & North-Western Ry.—A. We use the trough system of floor.

B. Where a girder span is used we aim to prevent the water following the lines of the girder by flashing along the side of the girder with asphalt.

C. We have not had any particular trouble on account of the expansion of metal cracking the concrete or waterproofing; we allow expansion joints.

D. After the surface is cleaned of dirt, a swabbing coat of asphalt cut with naphtha is put upon the concrete. I am sending you herewith our drawing, showing our standard plan for waterproof covering on track elevation work that covers our method of applying asphalt and mastic.

E. We do not use a felt covering.

F. Occasionally washed gravel is put on top of the mastic on which the ordinary ballast comes, but as a general thing the mastic, which is made in proportions of one to four, is hard enough to withstand any pressure.

The surface of concrete is to be clean and dry, and then to be thoroughly coated with a painting coat of asphalt cut with naphtha or gasoline. On this surface is to be laid 1½ inches of asphalt mastic made in proportion of one part of asphalt to four parts of clean sand. This is to be spread in place and well smoothed with smoothing irons. After this is completed, the entire surface is to be swabbed or mopped over with hot asphalt and sprinkled with sand. Concrete to be of composition 1:2½:4, the stone to pass through a 1-inch ring, with all crusher dust removed. Expanded metal to be laid across tops of floor troughs, and bent for gutters, joints to overlap at least 1 foot.

R. H. Reid, Lake Shore & Michigan Southern Ry.—A. We use I-beam construction for our solid floor bridges.

B. To prevent water following the line of girder and gussets we use a steel trough lined with concrete and protected with waterproofing; we use solid concrete filling between girders; we carry it up to the top flange and carry the concrete protection up beneath the top flange, as shown in plan B-2384 herewith.

C. We have not used solid concrete construction long enough to determine whether we will have any cracking due to expansion and contraction. My opinion, however, is that we will have no trouble from this source.

D. We are now using a gum called Sarco, manufactured by the Standard Asphalt & Rubber Company, of Chicago, and we put on one layer one-half inch thick, putting it on hot. In regard to the results obtained, will say we hope for the best, but have not used it long enough to give a reliable opinion.

E. We do not use any felt covering over concrete.

F. We protect waterproofing from stone ballast and coarse gravel by a 3-inch layer of fine gravel or sand.

G. We are not at present using any other methods than those outlined herewith, but we have taken out some of the old iron bridges in which transverse trough sections were used and filled with concrete in which the concrete was so firmly united that we have not yet succeeded in getting it out, although the trough sections have gone into the scrap pile. Apparently the concrete was in as good condition as when put in place.

In the way of general information will say that we have under construction at Keefe and St. Lawrence avenue, Chicago, at Park Manor station, two bridges in which we have used steel concrete floor over I-beams with the Sarco waterproofing. I herewith attach drawings of floors which we have recently designed with waterproof protection over concrete.

D. C. Zook, Pennsylvania Company.—G. I have under my charge at Winona Lake, Ind., a reinforced concrete bridge used as a subway at the station for the use of passengers. This reinforcing consists of 15-inch I-beams, 16 feet long, spaced 1 foot 6 inches on centers, the clear span of bridge being 12 feet. The construction of the bridge is as follows: The I-beams were placed in position and the under part of them was covered with wire fabric consisting of No. 10 woven wire, meshes being 3x8 inches. The spaces between the I-beams were then filled with concrete down to a point 2 inches below the bottom of the I-beam, completely covering them with concrete. The concrete was carried up to the top of the I-beams, covering them about half inch; on top of this the waterproofing was placed, consisting of 1 ply of Barrett's roofing laid 6 ply, thoroughly covering each ply with "Barrett's specification coal tar pitch" before the next ply was put on. On top of this waterproofing another coating of concrete was placed, making the thickness in center of span 6 inches, sloping to the ends of the I-beams, where it was made about 4 inches, the ends of the I-beams being enclosed in the concrete, which was rounded off so as to shed away the water. On top of

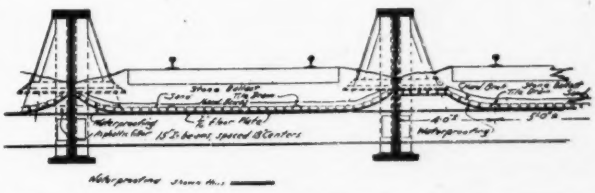


FIG. 9—C. R. R. OF N. J. METHOD OF WATERPROOFING BRIDGE FLOORS.

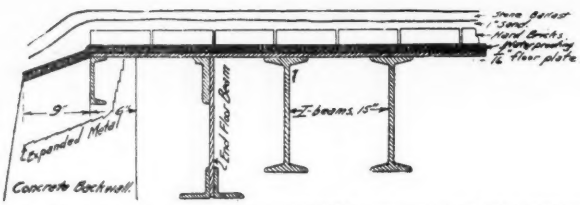


FIG. 10—C. R. R. OF N. J. METHOD OF WATERPROOFING BRIDGE FLOORS.

this concrete is placed the stone ballast, which is about 6 inches thick in the center of the span and 8 inches thick at the ends of the bridge between the concrete of the bridge and the bottom of the track ties. This bridge has been in service for two years and so far the waterproofing has been satisfactory.

J. N. Penwell, Lake Erie & Western R. R.—We are so fortunate as to have only two bridges on our system with tight floors over streets and none over other railroads. We have one at Akron which is covered with ordinary wooden floor laid of 7/8-inch lumber, and the water is conveyed to each end of the bridge, where it is allowed to spill along the side of the grade. This is not an absolutely tight floor.

We also have one over Massachusetts avenue at Indianapolis which consists of 5-inch creosoted loblolly pine flooring which is laid diagonal on the floor beams and is thoroughly calked and pitched. The water is conveyed to either end and is carried to sewer by means of a downspout which is built in the wall on the rear side. The floor is bolted to floor beams by means of hook bolt and the rail fastened on rail chairs by means of bolts.

Geo. W. Andrews, Baltimore & Ohio R. R.—In solid floor construction we ordinarily use I-beams where we can obtain sufficient depth. Trough floor construction is only used where I-beams cannot be used.

B. For through spans 100 feet and under girders are used, and the water is prevented from following the line of girder and gussets where the adhesion of the concrete and iron is imperfect by a bent plate riveted to the girder and projecting out over the concrete.

C. We have not had any trouble with the expansion of trough floors cracking the concrete and waterproofing, so far as I know.

D. We have not yet used a mastic to protect the waterproofing, but expect to give this method a trial.

E. We use a felt covering over the concrete, five ply. So far we have used only Hydrex felt laid in Hydrex hot compound.

F. This waterproofing felt is protected either by a layer of bricks or a 6-inch layer of concrete reinforced with wire mesh.

A. Montzheimer, Chicago, Lake Shore & Eastern Ry.—This year we will have several bridge floors to put in. They are I-beam floors and waterproofing will be laid on top of the I-beams. Concrete and waterproofing will be carried up alongside of gussets and girders, so no water can get in alongside of gussets and girders. Over the asphalt waterproofing will be laid a layer of mastic about 3/4 of an inch thick.

We have never used any felt covering for waterproofing concrete.

F. E. Schall, Lehigh Valley R. R.—We have built in one case a solid floor trough bridge. The troughs were filled with concrete and the whole surface of the floor covered with about 1¾ inches additional concrete above the troughs. Four-ply Hydrex felt was then placed over the entire floor, running up on the sides about 6 inches; then an additional layer of Portland cement concrete cover 1 inch thick was placed above the Hydrex felt; upon it was placed the stone ballast. In my judgment this is the best way to build solid floor bridges and waterproof them. The steel, where waterproofing is to be done, should not be painted, but should be kept black as it comes from the mill and thoroughly cleaned from rust, to have the Hydrex felt take a firm hold on the material. There are a number of other products, such as Sarco, Minwax, etc., on the market, and no doubt all of them are good for waterproofing if properly placed and of sufficient quantity.

A. F. Miller, Pennsylvania Company.—As chairman of your committee on "Waterproofing of Concrete Covered Steel Floor Bridges," I beg leave to submit a report of my experience with the different methods of waterproofing used in our track elevation work in Chicago in the past four years.

In 1904 in the waterproofing of subway bridge floors we used at first asphalt covering ¼ inch thick over concrete. This was found to be ineffective on account of the contraction and expansion, and its liability to puncture. We then used an asphalt mastic made of asphalt and screening thoroughly mixed in kettles, and applied while hot and thoroughly tamped, after which a ¼-inch layer of pure asphalt was poured over the bridge floor on top of the mastic, forming a blanket covering; but on account of the shrinkage when cooling, thus defeating the purpose for which it was intended, its use was discarded on account of ineffectiveness.

The second method tried out by us was concrete, covering the joints of the iron work with a substance known as iron bark, which was applied to the steel work of the bridge with hot smoothing or sad irons, which gave an excellent bond between the steel and the bark. Results very unsatisfactory, the contraction and expansion of

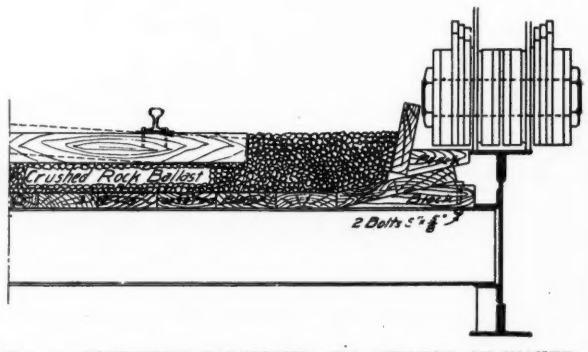


FIG. 11—SOUTHERN CALIFORNIA RY. METHOD OF WATERPROOFING BRIDGE FLOORS.

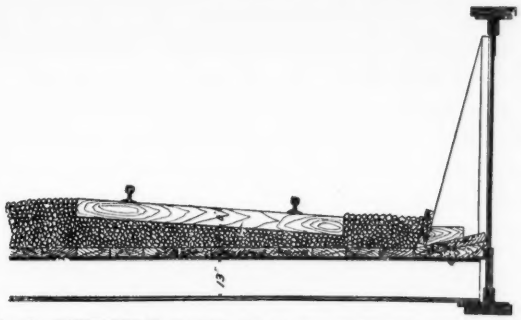


FIG. 12—SOUTHERN CALIFORNIA RY. METHOD OF WATERPROOFING BRIDGE FLOORS.

steel floor tearing the bark, thus defeating the purpose for which it was intended, and its use was discontinued.

Third method: In the latter part of 1904, at one of our subway bridges on the P., C., C. & St. L. Ry., we made a test of a felt covering over concrete, using three-ply felt thoroughly mopped with a Hydrex compound, over which was placed a layer of concrete 1½ inches thick, sidewalk finish to protect the felt from the stone ballast. This method has given us the best result. Care was taken not to allow any adhesion between the concrete and the felt over expansion joints, but was laid as a blanket over the concrete, thus allowing for any irregular contraction or expansion in the metal or concrete covering of the bridge floor proper.

In conclusion, I would say that the felt method has not given us an absolutely water-tight bridge floor, and that there is still room for great improvement along this line, but we have received the best results from the felt system in our elevation work.

SPECIFICATIONS AND INSTRUCTIONS FOR WATERPROOFING METAL AND MASONRY STRUCTURES, BY W. H. FINLEY, ASSISTANT CHIEF ENGINEER, C. & N. W. RY.

MATERIAL.

1. (a) Asphalt shall be used which is of the best grade, free from coal tar or any of its products, and which will not volatize more than ½ of 1 per cent under a temperature of 300 degs. F. for 10 hours.

(b) It must not be affected by a 20 per cent solution of ammonia, a 25 per cent solution of sulphuric acid, a 35 per cent solution of muriatic acid, nor by a saturated solution of sodium chloride. It should show no hydrolytic decomposition when subjected, for a period of ten hours, to hourly immersions in water with alternate rapid drying by warm air currents.

RANGE OF TEMPERATURE.

2. (a) For metallic structures, exposed to the direct rays of the sun, the asphalt must not flow under 212 degs. F., nor become brittle at 0 deg. F. when spread thin on glass.

(b) For structures under ground, such as masonry arches, abutments, retaining walls, foundation walls of buildings, subways, etc., a flow point of 185 degs. F. and a brittle point of 0 deg. F. will be required.

(c) A mastic made from either grade of asphalt by mixing it with sand must not perceptibly indent when at a temperature of 130 degs. F. under a load of 20 pounds per square inch. It must also remain pliable at a temperature of 0 deg. F.

PREPARING SURFACE.

3. (a) Before applying asphalt to a metal surface, it is imperative that the metal be cleaned of all rust, loose scale and dirt; and if previously coated with oil this must be burned off with benzine, or by other suitable means. The metal surface must be warm to enable the asphalt to adhere to it, and the warming is best accomplished by covering it with heated sand, which should be swept back as the hot asphalt is applied.

(b) When waterproofing masonry structures, if the surface cannot be made dry and warm, it should be first coated with an asphalt paint applied cold. This is particularly necessary for vertical surfaces. It is difficult to make either cold or hot asphalt adhere to the surface of concrete or mortar when the latter is covered with a thin film of cement. To overcome this the surface of the structure should be covered with a finishing coat of mortar composed of one part of cement to one part of sand. If this is not permissible the surface should be cleaned with a sand blast.

PREPARING ASPHALT.

4. The asphalt should be heated in a suitable kettle to a temperature not exceeding 450 degs. F. If this is exceeded it may result in "pitching" the asphalt. Before the "pitching" point is reached the vapor from the kettle is of a bluish tinge, which changes to a yellowish tinge after the danger point is passed. If this occurs the material should be tempered by the addition of fresh asphalt. The asphalt has been cooked sufficiently when a piece of wood can be put in and withdrawn, the asphalt clinging to it. Care should always be taken not to prolong the heat to such an extent as to pitch the asphalt; should it become necessary to hold the kettle for any length of time, bank or draw the fire and introduce into the kettle a quantity of fresh asphalt to reduce the temperature.

APPLICATION OF ASPHALT.

5. (a) The first coat should consist of a thin layer poured from buckets on the prepared surface and thoroughly mopped over.

(b) The second coat should consist of a mixture of clean sand or limestone screenings, free from earthy admixtures, previously heated and dried, and asphalt, the proportion of 1 part asphalt to 3 or 4 parts sand or screenings by volume; this is to be thoroughly mixed in the kettle and then spread out on the surface with warm smoothing irons, such as are used in laying asphalt

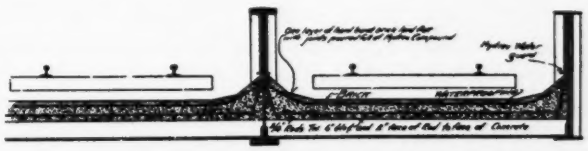


FIG. 13—BRIGHTON BEACH IMPROVEMENT, METHOD OF WATERPROOFING BRIDGE FLOORS.

streets. The irons should not be hot enough to burn the asphalt.

(c) The finishing coat should consist of pure hot asphalt spread thinly and evenly over the entire surface, and then sprinkled with washed roofing gravel, torpedo sand or stone screenings, to harden the top.

(d) The entire coating should not be less than 1 inch thick at the thinnest place.

BY AUSTIN LORD BOWMAN.

METHOD OF APPLYING WATERPROOFING.

First. The steel floor plate was thoroughly cleaned and painted with one coat of red lead and oil.

Second. A filler of mastic asphalt was placed along the webs of the girders.

Third. Five layers of Hydrex felt cemented together with Hydrex compound were then put on the floor plate and carried as far as possible up under the flashing angles, which were fastened along the webs and around the stiffeners and the ends of the girders. The felt was not cemented to the floor plate, but was thoroughly cemented to the webs of the girders.

Fourth. A layer of brick laid flat was then placed on the felt in a hot layer of compound, the brick being laid lengthwise of the bridges.

Fifth. The joints between the brick were thoroughly poured with compound and the whole surface mopped with compound.

Sixth. The stone ballast ties and rails were then placed on the bridge.

LABOR AND TIME ON WATERPROOFING AFTER STEEL WORK WAS ERECTED.

The skilled and common laborer employed per square (100 sq. ft.) was as follows: Foreman, 1.66 hours; waterproofers, 11.71 hours; laborers, 7.75 hours.

The overtime to complete a floor of 750 sq. ft. was 1.4 days of 10 hours. The best time for one track, 750 sq. ft., was one day of 10 hours.

COST.

The cost of waterproofing materials per square foot of floor surface was 20¾ cents.

The cost of labor per square foot was 10¾ cents.

Materials per square (100 sq. ft.): Brick, 440; Hydrex compound, 41.2 gals.; Hydrex felt, 1.46 rolls (400 sq. ft. per roll).

RESULTS.

The bridges are watertight, with the exception of a few points immediately over columns.

During a severe storm the water leaks down to some extent, between the main and sidewalk girders. It seems impossible to keep these points absolutely tight.

The vibration and reflection of the girders break the bond of any material which is placed between the ends of the girders. From a close observation of these bridges it seems impossible to make the compound adhere to the steel for any length of time, due to the vibration of the steel work and the hardening of the material during cold weather.

It is necessary to protect the edges of the waterproofing along the girders from water running down behind after the waterproofing has broken loose. This was done by means of the flashing angles referred to above.

No attempt should be made to fit the brick along the web or brackets, the brick being simply shoved as tight as possible and then the openings poured with the compound. Afterward the opening under the flashing angles should be filled with concrete to keep the edges of the felt from curling over.

The felt was carried well over and down the back walls, drainage being had by putting the bridges on a grade and allowing the water to run behind the abutments, which were drained by pipes running through the abutments to the gutters.

Of the six bridges referred to above five were very near together and so were erected in one group. The sixth was quite a distance away and was erected separately, so as to throw as little track out of service as possible.

All track changes were made by means of crossovers at each end of the groups of bridges to be erected. These crossovers were operated by switchmen and operators stationed at each group. And in addition the signals governing them were incorporated in the Electro Pneumatic Signal System of the road.

Prices on Track Materials, F. O. B. Chicago

Steel rail, 60 lbs. and over	$28.00 per gross ton
Steel rail, 25 to 45 lbs.	26.00 per gross ton
Steel rail, 20 lbs.	27.00 per gross ton
Steel rail, 16 lbs.	28.00 per gross ton
Steel rails, 12 lbs.	29.00 per gross ton
Tie, 6x8x8 oak, 1st grade	74c each
Ties, 6x8x8 oak, 2d grade	67c each

Angle bars, accompanying rail orders, 1908 delivery, 1.50c; car lots, 1.60c; spikes, 1.80c to 1.90c, according to delivery; track bolts, 2.15c to 2.20c, base, square nuts, and 2.30c to 2.35c, base, hexagon nuts. The store prices on track supplies range from 0.15c to 0.20c above mill prices. Switch set per turn out, 60-lb. rail, $85 to $90.

Old steel rails, rerolling	$16.00 to $16.50
Old steel rails, less than 3 ft.	14.75 to 15.25
Old iron rails	18.00 to 18.50

SHEET STEEL.

It is quoted for future delivery:

Tank plate, ¼-in. and heavier, wider than 6¼ and up to 100 ins. wide, inclusive, car lots, Chicago, 1.78c; 3/16 in., 1.88c; Nos. 7 and 8 gauge, 1.93c; No. 9, 2.03c. Flange quality, in widths up to 100 ins., 1.88c, base for ¼-in. and heavier, with the same advance for lighter weights; sketch-plates, tank quality, 1.88c, flange quality, 1.98c. Store prices on plates are as follows: Tank plate, ¼-in. and heavier, up to 72 in. wide, 2.00c to 2.10c; from 72 to 96 ins. wide, 2.10c to 2.20c; 3/16 in. up to 60 ins. wide, 2.10c to 2.25c; 72 ins. wide, 2.30c to 2.40c; No. 8 up to 60 ins. wide, 2.10c to 2.15c; flange and head quality, 0.25c extra.

STRUCTURAL STEEL SHAPES.

Store quotations are at 1.95c to 2.00c, and mill prices

are as follows Beams and channels, 3 to 15 ins., inclusive, 1.78c; angles, 3 to 6 ins., ¼ in. and heavier, 1.78c; larger than 6 ins. on one or both legs, 1.88c; beams, larger than 15 ins., 1.88c; zees, 3 ins. and over, 1.78c; tees, 3 ins. and over, 1.83c, in addition to the usual extras for cutting to extra lengths, punching, coping, bending and other shop work.

CAST IRON PIPE.

Quotations per net ton on water pipe, 4 ins., $27; 6 to 12 ins., $26; over 16 ins., $25; with $1 per ton extra for gas pipe.

CEMENT.

Good grade Portland cement, car lots.....$1.65 per bbl.*

*(Four sacks per bbl. credited 10c. each when returned in good condition.)

SAND.

Bank sand, car lot .....$0.75 per yd.
Torpedo sand, car lot ..... 1.15 per yd.

CRUSHED STONE GRAVEL.

Crushed limestone, car lot.....$1.05 per yd.
Crushed gravel, car lot..... 1.10 per yd.

Personal Mention

Mr. Frank Taylor, resident engineer of the Canadian Pacific, has been appointed division engineer of the Lake Superior division, with headquarters at North Bay, Ont.

Mr. L. N. Miller, engineer of maintenance of way of the Mexican Central, has been transferred from Chihuahua, Chih., Mexico, to Mexico City.

Mr. C. E. Lindsay, engineer of maintenance of way on the Electric Zone of the New York Central & Hudson River, has been appointed division engineer in charge of the Mohawk division, with headquarters at Albany, N. Y.

Mr. J. M. Fairbairn has been appointed assistant engineer of the Canadian Pacific.

Mr. L. S. Leake, supervisor of buildings of the Missouri Pacific Ry., has resigned to engage in contracting business in Chicago.

Mr. Charles A. Smith, chief assistant civil engineer of the Chicago & Western Indiana, died at Chicago, Ill., Oct. 21, of appendicitis.

Mr. Richard Hayes, who, as general foreman for the Chicago, Milwaukee & St. Paul, built many of the famous tunnels and bridges along that line, died in Butte, Mont., last week.

Mr. J. E. Griffiths, provincial government agent at Golden, B. C., and formerly in engineering work for the Canadian Pacific in charge of the construction of the snowsheds in the Rocky and Selkirk ranges, British Columbia, has accepted an offer to undertake similar work for the Trans-Andean line to run from Buenos Aires, Argentnia, to Santiago and Valparaiso in Chile. Mr. Griffiths has been out of engineering work for ten years.

Mr. J. M. McGreery has been appointed roadmaster of the Canadian Pacific at Nelson, B. C., succeeding Mr. H. Beck, assigned to other duties.

Mr. Weber began his engineering career at Bucyrus, O., in 1880, being appointed county surveyor and engineer to fill the unexpired term of Frank L. Plants, deceased; being afterwards elected to the office for four consecutive terms, during which time he also filled the office of city engineer of Bucyrus, O., filling both offices for a period of fourteen years, when he resigned to accept the appointment as city engineer of Richmond, Ind., which position he filled for eleven years. While acting

MR. H. L. WEBER.

as city engineer of Richmond he projected the scheme of building the C. C. & L. railroad from Cincinnati to Chicago which was successful and during its construction acted as consulting engineer and bridge engineer, building all the bridges along the line and in connection with Mr. H. L. Jackson, completed the entrance into Cincinnati. In June, 1905, he resigned the position of city engineer of Richmond to accept the position of chief engineer of the Fort Wayne & Wabash Valley Traction Company, which position he has held until his resignation was tendered on Oct. 9, 1908. Mr. Weber has a very flattering offer with a project in the west for building a steam road; also with a traction company in the east and is undecided at this particular time which he will accept. Mr. H. V. Norford, engineer maintenance of way, has been left in charge temporarily and will no doubt be appointed as Mr. Weber's successor.

Mr. George S. Foster has been appointed division engineer and bridge inspector of the Chicago, Cincinnati & Louisville at Chicago, succeeding Mr. E. B. Espenshade, resigned.

Mr. G. L. Wetmore has been appointed division engineer of the Atlantic division of the Canadian Pacific, with office at St. John, N. B.

Mr. William Corliss has been appointed roadmaster of the Union Pacific, having jurisdiction over the line between Laramie, Wyo., and Cheyenne, succeeding Mr. E. J. Borland, transferred.

Mr. F. J. Hemphill has been appointed signal supervisor of the Illinois division of the Chicago, Rock Island & Pacific, with office at Ottawa, Ill.

Mr. G. W. Trout, signal engineer of the St. Louis & San Francisco, has been appointed signal supervisor of the Missouri division of the Chicago, Rock Island & Pacific, with office at Cedar Rapids, Iowa.

Mr. Francis Boardman, division engineer, Electric division, of the New York Central & Hudson River, has succeeded to the duties of Mr. C. E. Lindsay, engineer of maintenance of way, Electric Zone, that office having been abolished and Mr. Lindsay having been transferred.

Trade Notes

Mr. W. M. Duane, chief engineer of the Cleveland, Cincinnati, Chicago & St. Louis, has resigned to become vice-president and general manager of the Walsh Construction Co., Davenport, Iowa.

Mr. C. R. Robinson, formerly sales agent for the Inland Steel Co., of Chicago, Ill., resigned to accept the position of Chicago representative for the Lackawanna Steel Co., with the title of district sales agent. Mr. Robinson will have offices in the Commercial National Bank building, Chicago.

The Raymond Concrete Pile Company, New York, through Chas. F. Uebelacker, chief engineer, Metropolitan Street Railway Company, has been awarded a contract for placing Raymond concrete piles in the foundations of new car barns that are to be erected at 54th street and 9th avenue, New York.

The Kellogg Switchboard & Supply Co. have recently issued a folder, describing their new push button inter-communicating system. Five views showing wall and desk set styles, both open and closed, are given. The illustration shows it to be one of the most compact, private, automatic, house systems on the market. Being compact, it is necessarily simple in operation. The accessibility and rigidity of these sets are clearly shown in the illustrations of open views. Both styles, wall and desk sets, are easily handled, and attractive in appearance. They are finished in either oak or mahogany, and add to the appearance of any office or room, because of the high grade of cabinet work, for which all Kellogg apparatus is noted. The desk set box takes up little room, and can be used either movably or placed in any convenient position on a desk or table. The company will be glad to send these folders to those interested, and will also, if requested, forward original photographs which give accurate views of both styles and sizes.

Improvements in machinery owned by The Rail Joint Co. of New York, for the manufacture of their base supporting rail joints, are constantly being added to their plants for the making of their products for standard tee and girder rail sections, also various types of rail joints for insulated work. The joining of odd sections of rail, with perfect alignment, is accomplished with their latest compromise or step joints. The total output of this company is shown by their records at the close of September, as being more than sufficient to equip over 50,000 miles of railway—deliveries having been made throughout the past fourteen years, being enough to construct a double track railway around the globe.

The American Diamond Blast Co., New York, has acquired the Anti-Hydro waterproofing business and is prepared to sell this material in lots of five gallons and upwards, and to handle contracts of any description calling for general structural waterproofing. Mr. F. M. Hausling, consulting engineer, is manager of the waterproofing department.

The Balfour Spike & Manufacturing Co. has been incorporated in Washington with a capital stock of $100,000. The articles of incorporation state that the principal purposes of the company are to purchase the patent on a safety railroad spike and to carry on a business of manufacturing and selling spikes and subsequently to secure rights in foreign countries. The incorporators are: Messrs. John W. Balfour, Robert H. Buddy, Charles Rickabaugh, M. W. Dibble and Frank Armstrong.

The American Water Softener Co., Philadelphia, is installing a 500,000 gallon filter plant for the Kanawha & Michigan at Hobson, Ohio.

The Cleveland Railway Supply Co., Cleveland, Ohio, has been incorporated with a capital of $30,000. The incorporators are: Messrs. W. S. Newhall, R. M. Morgan, C. S. Beardsley, F. H. Forest and O. G. Armstrong.

W. R. Brixey has incorporated his business as manufacturer of Kerite insulated wires and cables under the name of the Kerite Insulated Wire & Cable Co. The officers are: Messrs. R. D. Brixey, president and treasurer; R. W. Brixey, vice-president, and A. D. Brixey, secretary. There will be no change in ownership or management and the business will be conducted as heretofore.

Technical Publications

BRIDGE ENGINEERING ROOF TRUSSES, by Frank O. Dufour, C. E., assitsant professor of civil engineering, University of Illinois. Published by the American School of Correspondence, Chicago. Half-morocco binding, 384 pages, 6x9 ins., illustrated Price, $3.00.

The volume is a manual of practical instruction in the calculation and design of structural steel truss and girder bridges for railroads and highways, including also the analysis and design of roof trusses and other details of mill building construction.

The fact that this work by Professor Dufour has been officially adopted as a text-book at the University of Illinois, is evidence of its value as a contribution to the literature of structural engineering. It is admirably adapted for the general practical use of the engineer. The problems involved in the calculation and design of modern steel structures are complicated, yet are adequately compassed here in a handy volume of moderate proportions. The treatment is exceedingly clear and concise, and free from the abstruse mathematics that ordinarily overburden other works in this difficult field. The section on bridge engineering treats fully both bridge analysis and bridge design, embracing the various types of truss and girder bridges, bridge piers and abutments, bearings, and other details, for railroads, country highways, etc. Every detail is explained by the aid of diagrams, while graphical methods are chiefly used in the computations. Photographs of representative bridges of the different types, gathered from different parts of this country and abroad, are introduced in profusion, and add greatly to the value and attractiveness of the text.

The same practical and concise treatment marks the section on roof trusses, which covers all details of the analysis, calculation and design of the various types of roof trusses used for buildings of various spans, the methods of securing good light and ventilation, the layout and other details of mills, shops, etc. Photographs of typical modern structures are shown, with full explanation of the methods followed in their design, and in some cases statements of cost. An analytical index is supplied, which immeasurably increases the value of the book as a work of reference. The work throughout is eminently practical, as it takes up in the most direct manner, just those problems which daily confront the practicing architect concerned in the design of roof trusses, or the bridge builder designing members for various spans.

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